A NEW NEEDLEMINER OF LODGEPOLE PINE IN OREGON

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FOREWORD

The appearance in 1925 of a lepidopterous needleminer in the lodgepole pine forests near Lapine, in central Oregon, led to a brief examination of the infested area by the writer in the summer of 1927. At this time a few notes on its seasonal history and injury to the host were made and a series of adult moths collected. Later, in August, 1928, a more detailed study was made in the same locality.

In the following brief report the life history and habits of this needleminer are presented, insofar as these are at present known, together with the results of a preliminary study of injury to the host. The amount of data at hand is admittedly insufficient for a thorough presentation of the subject, but it is all that could be secured in the short time possible to devote to it. If the infestation persists, further examinations should be made and additional information added to the present groundwork.

RECURVARIA N.SP.

This Tineid very closely resembles Recurvaria milleri Busck in size, markings and also in habits. Specimens collected in the area studied in July, 1927, were identified by Carl Heinrich as a new species of Recurvaria. This is the first known record of its occurrence in Oregon, and so far it is known to attack only lodgepole pine (Pinus contorta Loud.).

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The original field notes and material collected are filed under Hopk. U.S. Nos. 16262a and 16282a.

LIFE HISTORY AND HABITS

The generations of this Recurvaria are annual. The life cycle of the species covers a period of twelve months. The adults emerge between July 15 and August 5 each year. After emergence from the mined needles, in which pupation takes place, they remain about the host trees, either taking short flights from tree to tree or resting on the foliage. Mating takes place while the moths are at rest on the foliage. During the flight period myriads of moths may be scattered from the trees by vigorously shaking them.

The eggs are deposited on the foliage, principally about the base of the needles and sometimes in the needle sheaths. This stage lasts from about July 20 to August 25.

Larvae start hatching about August 15 and all are out of the eggs by early September. The young larvae attack the needles near the outer end (Fig.1 Pl.2) and enter the axis by eating a small hole through the epidermis. The larval mines are extended toward the base of the needle. From half to three-quarters of the length of each needle attacked is mined (Fig.2 Pl.2). The larvae remain in the attacked needles through the winter and pupate in them the following summer. It has not been determined whether an individual larva attacks more than one needle during its development or if its entire life is spent in the needle first attacked.

The formation of pupae begins in late June and continues through early July. This stage lasts from about June 20 to August 5, the new adults emerging during the latter half of this period. A chart of the life history of this species is shown in Fig. 1.

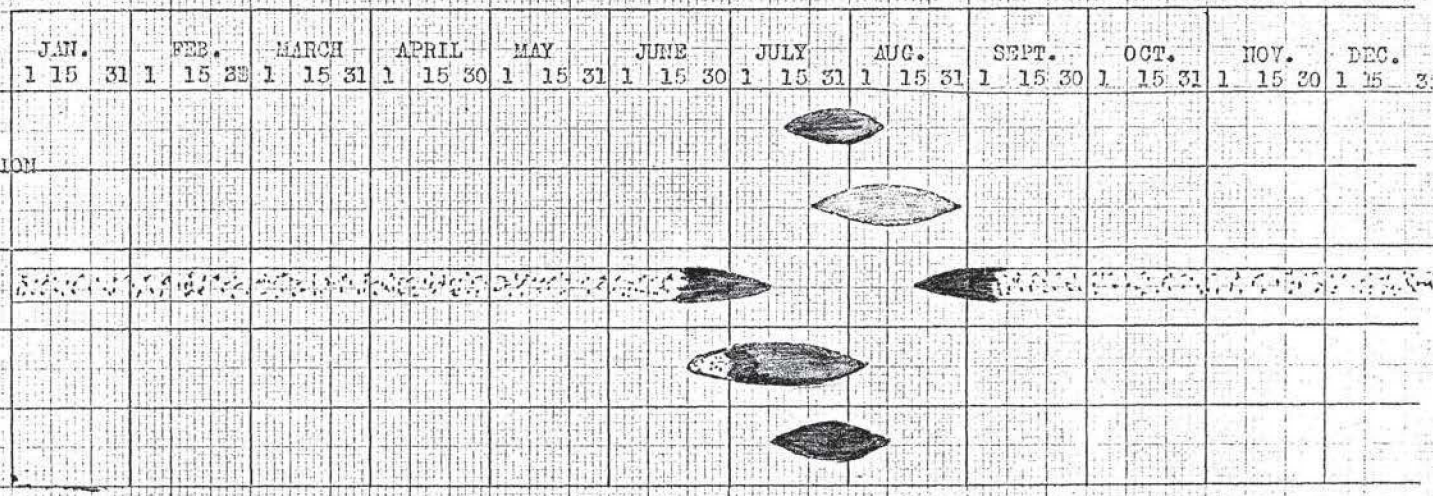


Fig. 2. - Life history of the lodgepole pine needleminer, Recurvaria n.sp.
(Stipple represents assumed data and is not based on actual records)

THE INFESTATION AREA

The present epidemic infestation covers an area of about 130 square miles, located on the headwaters of the Deschutes River. The town of Lapine is situated near the center of the infested area. The Dalles-California Highway passes through the main portion, and defoliated trees may be seen on both sides of this road for a distance of thirteen miles.

The forest cover of the infestation area is composed almost wholly of lodgepole pine with a slight admixture of yellow pine. The lodgepole forest is of the usual type, consisting of small to medium-sized trees forming fairly dense stands interspaced with open meadows. The soil is composed of loosely packed volcanic pumice, characteristic of the central Oregon region. The average elevation of the infested area is 4,500 feet.

NATURE AND EXTENT OF INJURY

The primary injury caused by this needleminer is the hollowing-out of the body of the needles by the feeding larvae, which results in the death of the needle affected regardless of the amount of needle body mined. Repeated, severe defoliations may result in the death of the tree. However, in this epidemic the annual defoliations have not been serious, and few trees have died directly from this cause. The few that have succumbed were suppressed trees with thin crowns. Their death was the probable result of a combination of causes of which defoliation may have been only a factor.

The greatest damage resulting from defoliations is impaired vitality and a reduction in growth rate. In Table I is shown the average annual growth rate of 11 defoliated trees in the epidemic area for six years before first defoliation and three years after. Table II shows the growth rate of ten non-defoliated trees in an adjacent stand during the same period. Curves of the average annual radial increment, based on these tables, are shown in Fig. 2.

Since these annual defoliations have not been severe and have occurred for only the past four years, the suppression of ring growth has not yet been great. However, if the defoliations continue with greater severity the suppression of growth will be pronounced.

Trees greatly suppressed from this cause are very susceptible to barkbeetle attack. This has been proven by the history of the needleminer-defoliated lodgepole pine forests in the Yosemite National Park, where these defoliated stands were killed in a few years by the mountain pine beetle.

There is at present an incipient infestation of the mountain pine beetle in these defoliated stands. Further suppression of the attacked trees may result in an epidemic of this beetle, with the consequent death of thousands of trees.

TABLE I - BASAL RADIAL INCREMENT OF ELEVEN LODGEPOLE PINE TREES WHICH HAD BEEN DEFOLIATED BY THE BEEDLEMINER, (Recurvaria sp.)

Tree No.	Width of annual basal ring in 1/100 mm.									
	1919	1920	1921	1922	1923	1924	1925#	1926	1927	1928
1	1.71	1.60	1.90	1.00	1.30	1.82	1.90	1.80	2.15	2.20
2	.25	.20	.30	.30	.34	.23	.20	.25	.15	.20
3	1.70	1.00	1.20	1.22	1.18	1.28	1.06	.88	.14	.12
4	2.00	1.87	1.86	1.47	1.76	1.30	.95	.95	.94	.58
5	.66	.52	.58	.42	.30	.35	.40	.45	.16	.22
6	1.35	1.08	1.21	1.11	1.15	1.09	.52	.41	.36	.50
7	2.10	1.90	2.47	1.80	1.84	2.08	2.07	1.90	1.51	1.21
8	2.45	1.70	2.43	2.10	2.73	2.52	1.82	1.47	1.08	1.19
9	.60	.55	.68	.47	.58	.42	.38	.38	.20	.20
10	1.45	.81	.58	.42	.34	.15	.17	.09	.08	.08
11	1.51	.80	1.23	.91	.75	.85	.94	.95	.35	.47
Totals	15.78	12.03	14.44	11.22	12.27	12.09	10.41	9.53	7.12	6.99
Average	1.43	1.09	1.31	1.20	1.12	1.10	.95	.87	.65	.63

$\frac{7.25}{6} = 1.21$ ave

$\frac{3.10}{4} = 0.78$

TABLE II - BASAL RADIAL INCREMENT OF TEN NON-DEFOLIATED LODGEPOLE PINE TREES TEN MILES DISTANT FROM DEFOLIATED AREA.

Tree No.	Width of annual basal ring in 1/100 mm.									
	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
1	3.17	3.24	3.00	2.68	3.04	2.80	2.31	3.02	2.36	3.00
2	2.81	2.80	2.72	2.02	1.71	1.57	1.46	1.73	1.36	1.62
3	2.44	1.90	2.80	2.00	2.45	2.20	2.02	2.08	1.62	1.50
4	1.40	1.12	1.82	1.25	1.71	1.50	.87	.95	1.30	1.23
5	2.72	2.54	3.00	2.58	2.85	2.55	2.70	3.16	2.37	2.78
6	1.90	2.05	2.00	1.75	1.71	1.88	1.67	1.80	1.70	2.20
7	2.00	2.70	2.55	1.52	1.64	1.43	1.60	1.76	1.42	2.13
8	1.60	1.35	1.62	1.42	1.25	1.17	1.12	.90	1.25	2.00
9	3.10	2.60	3.42	2.64	3.00	2.66	2.42	2.55	2.20	2.65
10	1.25	1.18	1.12	.97	.95	.73	.76	.64	.88	1.16
Totals	22.39	21.48	24.05	18.83	20.32	18.49	16.93	18.59	16.46	20.27
Averages	2.24	2.15	2.40	1.88	2.03	1.85	1.69	1.86	1.65	2.03

$\frac{13.55}{6} = 2.25$ ave

$\frac{7.23}{4} = 1.81$

First year of feeding of Recurvaria larvae.

Is this a valid comparison?

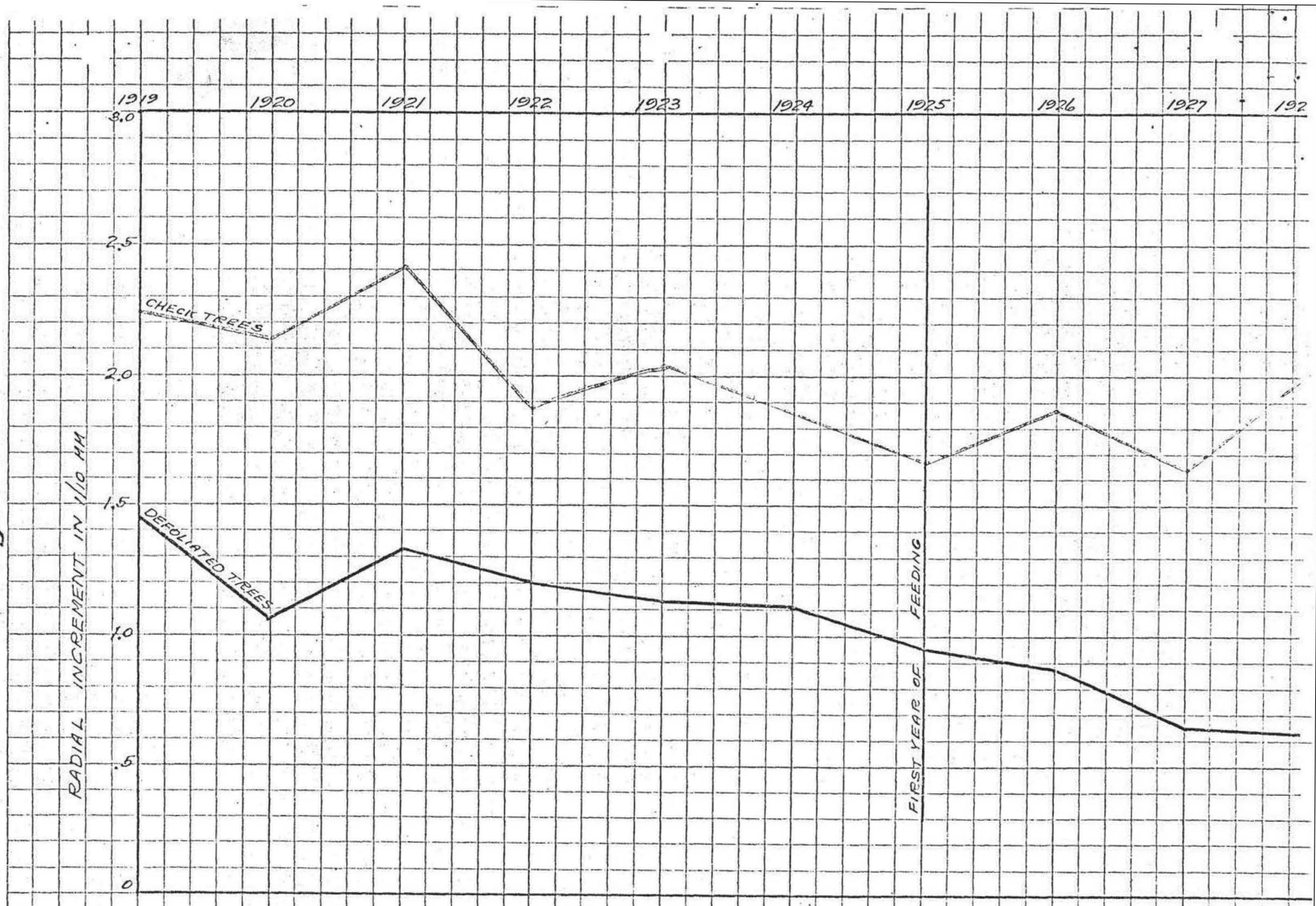


Fig. 2. – Average annual increment of eleven defoliated trees and of ten check trees at LaPine, Oregon. (Lodgepole pine needleminer, Recurvaria n.sp.)

CHECK AREA

In order to facilitate further study of this infestation and to make it possible to determine the extent of primary injury resulting directly from defoliations, and also to secure data on the development of the barkbeetle infestation in the defoliated stands, a check area of 100 defoliated trees was established in August, 1928.

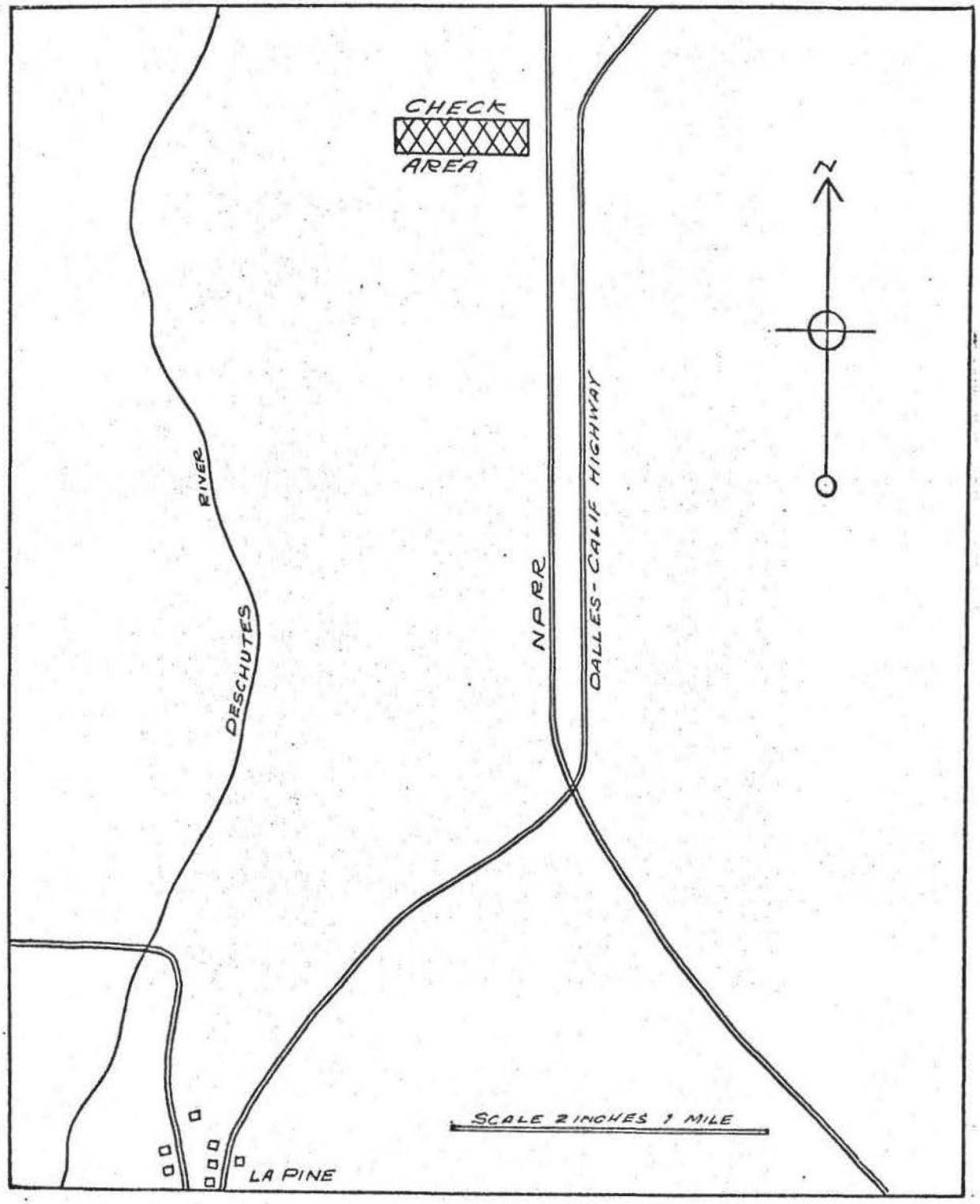
The trees on this check area were each marked with a metal disc bearing a serial number for future identification of individual records. The trees were also blazed well beneath the cambium in order to date subsequent ring growth. The individual tree records taken at the time consisted of recording the diameter, height and amount (percentage) of defoliation. These data are given in Table III.

A sketch map showing the location of the check area is given in Fig. 3.

TABLE III- Diameter, height, and amount of defoliation of numbered trees on sample plot check area. August 14, 1928.

Tree number	Diameter	Height	Amount of Defoliation	Tree number	Diameter	Height	Amount of defoliation
1	16"	45'	20%	51	12"	35'	20%
2	16	50	40%	52	6	35	80%
3	16	45	20%	53	6	20	80%
4	8	30	20%	54	8	35	80%
5	8	30	20%	55	4	15	80%
6	8	30	40%	56	6	20	80%
7	12	25	20%	57	6	20	80%
8	10	45	20%	58	3	10	80%
9	8	45	20%	59	8	30	80%
10	12	45	20%	60	4	15	20%
11	10	40	20%	61	6	20	20%
12	8	40	20%	62	4	15	80%
13	6	40	20%	63	4	15	80%
14	14	30	20%	64	3	12	80%
15	18	30	20%	65	3	12	80%
16	16	30	20%	66	8	30	80%
17	20	40	20%	67	16	40	80%
18	16	35	20%	68	6	25	20%
19	14	50	20%	69	4	15	80%
20	12	40	20%	70	8	20	80%
21	12	40	20%	71	6	20	40%
22	16	40	20%	72	3	12	30%
23	24	55	20%	73	3	12	20%
24	18	45	20%	74	4	12	20%
25	12	40	20%	75	12	30	20%
26	16	40	20%	76	6	15	40%
27	6	30	20%	77	8	30	40%
28	16	35	20%	78	8	20	20%
29	20	40	20%	79	6	20	40%
30	16	40	20%	80	6	20	40%
31	20	45	20%	81	12	40	40%
32	20	45	20%	82	20	60	20%
33	14	30	80%	83	8	20	20%
34	4	20	80%	84	6	20	80%
36	4	20	80%	85	8	20	80%
36	6	25	40%	86	4	12	80%
37	3	20	40%	87	6	20	80%
38	4	20	40%	88	8	30	80%
39	4	25	40%	89	8	30	80%
40	7	30	40%	90	10	40	80%
41	4'	25	40%	91	6	20	40%
42	3	25	80%	92	12	40	80%
43	6	25	80%	93	12	40	40%
44	4	25	80%	94	6	30	20%
45	12	40	80%	95	14	40	40%
46	8	30	20%	96	14	40	40%
47	10	30	40%	97	12	50	40%
48	12	40	40%	98	6	30	80%
49	6	30	80%	99	6	30	20%
50	14	50	40%	100	8	30	20%

Fig. 3. - Sketch map showing location of needleminer check area near LaPine, Oregon. This check area of 100 numbered, defoliated, trees is located in a stand where the present epidemic infestation had its inception. The specific location is immediately west of the N.P.R.R. 3½ miles north of the town of LaPine where the Dalles-California Highway departs from the straight tangent paralleling the railroad.



SUMMARY

The appearance of a new species of needleminer in central Oregon led to a preliminary study of its life history and damage. The following points were brought out in this brief study of the moth and of the infested area.

1. This new Recurvaria is closely related to the lodgepole pine needleminer, Recurvaria milleri Busck, both in habits and character of damage.

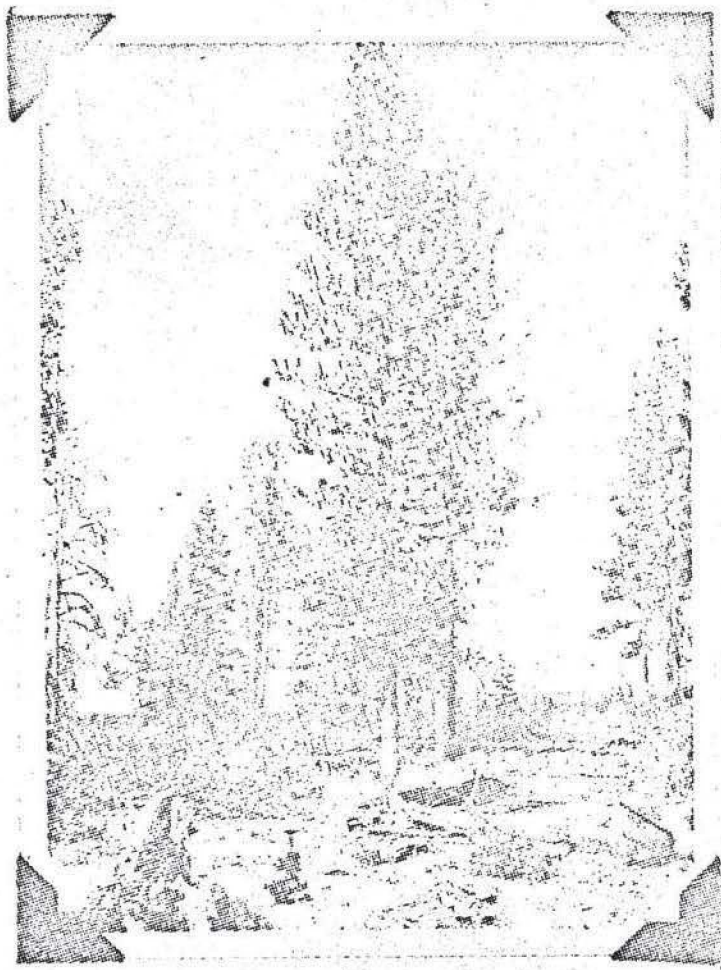
2. It has one complete generation each year instead of the biennial life cycle of Recurvaria milleri. The season of greatest activity is from June 20 to September 15. During this period flight, oviposition, hatching of larvae, attack of new needles and pupation occur.

3. It first appeared in the present epidemic infestation area in 1925. The present infestation covers an area of 130 square miles. It attacks only lodgepole pine.

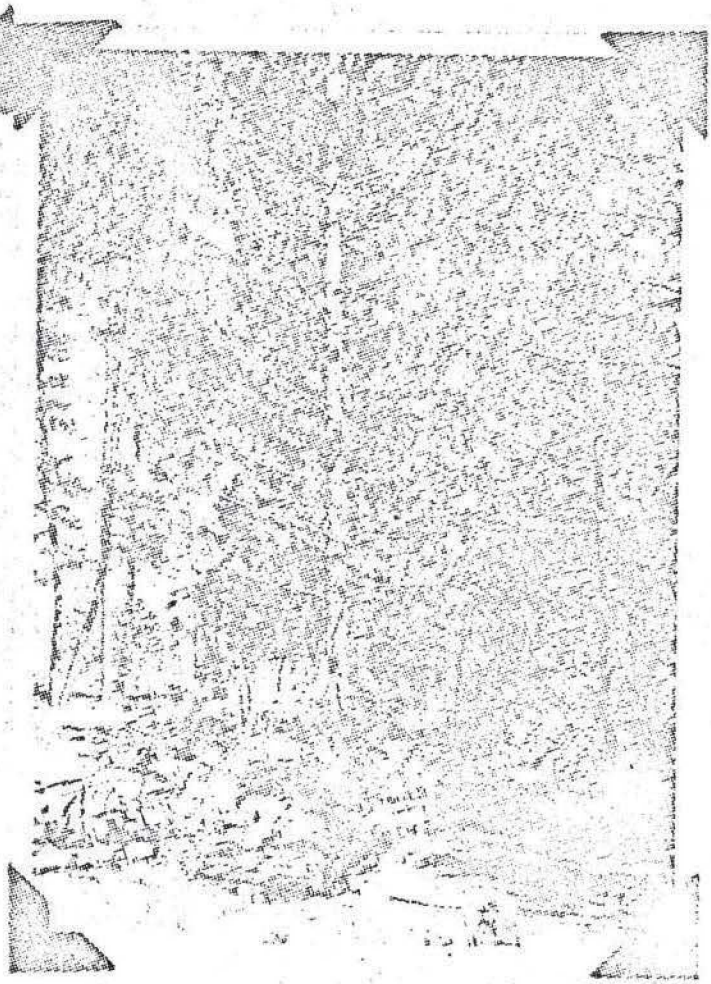
4. The primary injury to the host results from defoliation and is a retardation of ring growth. All needles successfully attacked die and fall during the first winter following emergence of the moths. Very few trees in this area have so far died as a direct result of defoliation.

5. An infestation of the mountain pine beetle has started in the defoliated stands. The increase of this infestation to epidemic status will result in great devastation in the weakened stands.

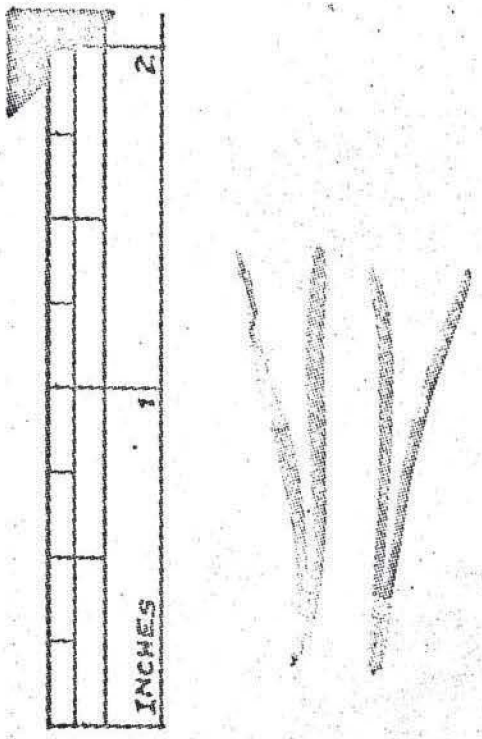
6. A check area was laid out for future study of this infestation.



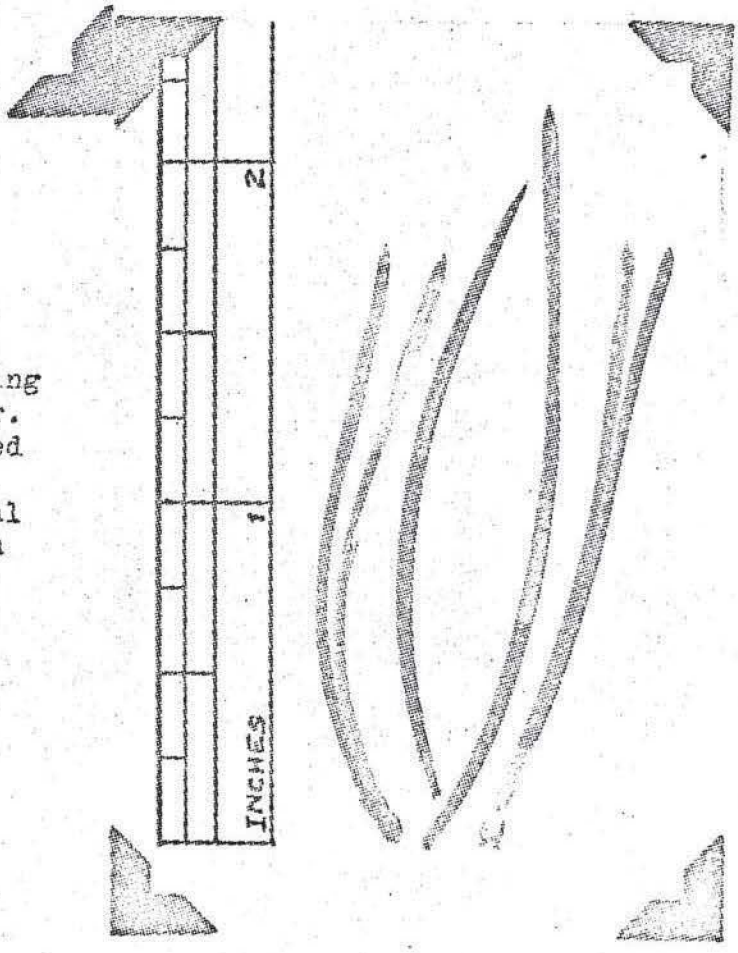
Lodgepole pine trees near La Pine, Oregon, defoliated by the needleminer, Recurvaria n.sp. Negative made on pan emulsion to render the whitish mined needles in contrast with the unmined green needles. The greatest damage to these trees has been in the middle crown.



Close up of small tree showing mined needles. The light colored needles were mined by the 1927 generation of the moth. The needles mined the previous year are not present since they fall during the winter following death.

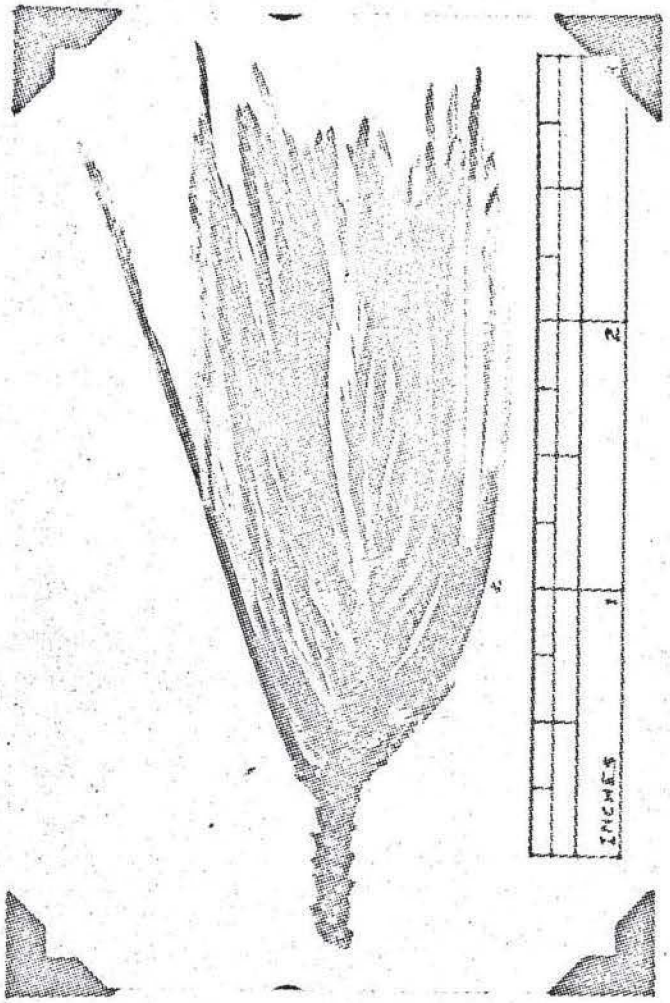


Needles of the 1928 crop which were attacked in late August by the young caterpillars of the new brood. The outer one-half of these needles had died as a result of the damage.



Needles of the 1927 crop showing mined portion in lighter color. These needles were photographed after emergence of the 1927 brood of moths. The empty pupal cases show as dark sections in the mined portion.

PLATE III.



A terminal showing mined needles of both the 1927 and 1928 growths. Since the young caterpillars, after hatching, attack the needles of the current year's growth the seasonal damage is confined to the latest growth.